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## Geographical variation in the Saffron-billed Sparrow *Arremon flavirostris*

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The Saffron-billed Sparrow *Arremon flavirostris* is a 30 g sparrow of forest undergrowth, which occurs in the southern half of Brazil, eastern Bolivia, Paraguay and northern Argentina (Meyer de Schauensee 1982). It is characterized by a mostly orange-yellow bill with a black ridge, black head with a barely suggested grey stripe along the median portion of the pileum, white superciliary that is variable in extension, black auriculars, grey or olive-green back, and mostly white underparts with a black pectoral band.



Figure 1. Distribution of *Arremon flavirostris*: ▼, *A. f. flavirostris*; ●, *A. f. polionotus*; ■, *A. f. dorbignii*.

The last comprehensive review of the geographical variation of *A. flavirostris* was carried out by Hellmayr (1938), who recognized two groups of subspecies: the green-backed group (*flavirostris* and *dorbignii*) and the grey-backed group (*polionotus* and *devilli*).

The taxonomy of the green-backed group is well resolved. *A. f. flavirostris* Swainson, 1837 is characterized by white superciliaries which start just above the eye. It is found in central-eastern Brazil (Fig. 1), in the states of Bahia, Minas Gerais, northeastern São Paulo, southeastern Goiás, southeastern Mato Grosso do Sul (Hellmayr 1938, Pinto 1944, Paynter 1970) and eastern Paraná (F. C. Straube). *A. f. dorbignii* Sclater, 1856 is very similar to *A. f. flavirostris*, but differs in that its white superciliaries are longer, beginning near base of the bill. It is found (Fig. 1) from Bolivia (La Paz, Cochabamba and Santa Cruz) to Argentina in Jujuy, Tucumán and Catamarca (Hellmayr 1938, Paynter 1970).

The geographical ranges and diagnostic characters of the subspecies of the grey-backed group have been disputed. *A. f. polionotus* Bonaparte, 1851 was described from a specimen collected in Corrientes, Argentina. The type locality of *A. f. devilli* Des Murs, 1856 has not yet been designated. The label of the holotype, collected by Castelnau's expedition to South America, records "Province of Goyas" (Hellmayr 1938). This is a mistake, because all collections subsequently made in Goiás have recorded only *A. f. flavirostris* (Pinto 1936, Hellmayr 1938, Silva 1989). Hellmayr (1938) stated that *polionotus* occurs in Paraguay, Argentina (Formosa, Chaco, Misiones and Corrientes) and western Paraná, while *devilli* occurs in western São Paulo, Mato Grosso and Mato Grosso do Sul and Chiquitos, Bolivia. Pinto (1944) disagreed with this statement and classified the specimens from Mato Grosso as *polionotus*, limiting the distribution of *devilli* to western São Paulo.

These discrepancies are the result of the lack of consistent diagnostic characters to distinguish the two subspecies. Both subspecies have short superciliaries similar to *A. f. flavirostris*. Hellmayr (1938) stated that *devilli* is "Very similar to *A. f. polionotus*, but upper parts paler gray with a slight olivaceous suffusion, and black jugular narrower". However, a few paragraphs later he qualifies this statement: "While the narrow jugular band (from three to seven millimeters wide) serves to distinguish this form from *polionotus*, the coloration of the back is not an absolutely constant feature . . .".

To resolve this question, I have examined 55 specimens of the two subspecies deposited at the American Museum of Natural History. I agree with Hellmayr that colouration of the back is not a consistent difference between these populations of *Arremon flavirostris*. I measured the width of the pectoral band in 33 males of '*polionotus*' and 19 males of '*devilli*'. In *polionotus* the range of this measurement was 6.0–11.0 mm (median = 8.2; s.d. = 1.6), while in *devilli* it was 5.0–10.0 mm (median = 6.9; s.d. = 1.2). The difference in the range of measurements for *devilli* recorded by me and by Hellmayr may be due to differences in skin preparation between the series he examined and those in AMNH. While the means in my data for pectoral band width are significantly different (Student's  $t = 3.07$ ;  $df = 49$ ;  $P < 0.001$ ), the measurement overlap is extensive and it is impossible to allocate individual specimens to either subspecies. Based on these observations, I propose that *devilli* be synonymized with *polionotus*, which has priority.

The three subspecies of *A. flavirostris* are well differentiated. In addition, no hybridization zone between these populations is known. Thus, they could be considered distinct species, whether the phylogenetic species concept (Cracraft 1983, McKittrick & Zink 1988) or the biological species concept (Mayr 1963) is utilized. However, I prefer to await new specimens from possible intergradation zones before proposing this change of rank. In general, *flavirostris* and *dorbignii* are the most similar to one another, but they are geographically separated by the very distinct *polionotus* (Fig. 1). This pattern is similar to cases of 'leapfrog' distribution in Andean birds (Remsen 1984).

To generate a hypothesis on the relationships between the subspecies of *A. flavirostris*, I performed a cladistic analysis (Wiley 1981) of the two

apparently informative plumage characters. *A. t. taciturnus*, the nearest hypothesized relative (Sick 1986), was used as the out-group.

The olive-green back colouration that is shared by *flavirostris* and *dorbignii* can be considered plesiomorphic because it is encountered in *A. t. taciturnus* and is widespread in *Arremon*. Grey back colouration is unique in this genus and is here interpreted as an autapomorphy of *polionotus*.

The extension of the white superciliaries is another character useful for phylogenetic inference. Long white superciliaries extending very nearly to the base of the bill occur in the out-group, and therefore can be considered plesiomorphic. Short white superciliaries are therefore interpreted here as a synapomorphy of *flavirostris* and *polionotus*.

Based on these two characters, Hellmayr's (1938) hypothesis on the relationships within *A. flavirostris* superspecies is invalid, because the character taken to be a phylogenetic indicator (olive-green back) for proximity between *flavirostris* and *dorbignii* is a plesiomorphy. On the other hand, *flavirostris* and *polionotus* share a synapomorphy (short white superciliaries), supporting the hypothesis that both are nearer to one another than either is to *dorbignii*.

This preliminary analysis supports the hypothesis that the leapfrog pattern of geographical variation of plumage colouration in *A. flavirostris* was produced by the retention of a primitive character by geographically extreme taxa (*flavirostris* and *dorbignii*) with a more rapid phenotypic differentiation in the central taxon (*polionotus*).

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